CLAIMS:

1. An image processing apparatus (1) for the reconstruction of time-dependent representations $I(x,t)$ of an object (2), comprising

- an approximation module with memory storing the N-dimensional parameter vector $a(x)$ of a predetermined parametric model function $I^*(a(x),t)$ that approximates the function $I(x,t)$;
- an input module for the reception of a set of projections p^i_j of the object (2) generated at times t^i_j, and
- an estimation module that is adapted to estimate the parameter vector $a(x)$ with the help of said projections p^i_j.

2. An apparatus according to claim 1, characterized in that it comprises an evaluation module for the determination of a perfusion map from the representation $I^*(a(x),t)$ of a vessel system.

3. An apparatus according to claim 1, characterized in that the representation $I(x,t)$ and its approximation $I^*(a(x),t)$ describe for each time t a cross-sectional image of the object.

4. An apparatus according to claim 3, characterized in that the estimation of the parameter vector $a(x)$ is based on the update function $\Delta I(x, p^{i(k)}, I^k(x))$ of an iterative algorithm for the reconstruction of a stationary cross-sectional image $I(x)$, wherein $p^{i(k)}$ is a projection used in the k-th iteration step and $I^k(x)$ is the k-th estimate for $I(x)$.

5. An apparatus according to claim 4, characterized in that the parameter vector a(x) is iteratively approximated by a sequence $a^k(x)$, wherein the (k+1)-th iteration comprises the following steps:

a) computation of estimates $I^*(a^k(x),t^i_j)$ for at least N of the times t^i_j, wherein $i \in A$ and $j \in B$ for some index sets A, B;

b) computation of corresponding updates $\Delta I^{k,i}_j = \Delta I(x, p^i_j, I^*(a^k(x),t^i_j))$ with the help of said estimates $I^*(a^k(x),t^i_j)$ and the measured projections p^i_j that correspond to the times t^i_j;

c) calculation of the new estimate $a^{k+1}(x)$ for the parameter vector a(x) by minimising

$$\chi^2(x) = \sum_{i\in A, j\in B}\left(I^*(\underline{a}^{k+1}(x),t^i_j) - I^*(\underline{a}^k(x),t^i_j) - \Delta I^{k,i}_j(x)\right)^2.$$

6. An apparatus according to claim 1, characterized in that the set of measured projections p^i_j can be divided into M subsets, wherein each subset comprises only projections p^i_j, j = 1,...Q taken from the same or approximately the same direction (d^i) at different times t^i_j, and wherein $Q \geq N$.

7. An apparatus according to claim 1, characterized in that the estimation of the parameter vector a(x) is based on the minimization of an objective function evaluating the deviation between the measured projections p^i_j and corresponding projections $P_i\, I^*(a^k(x),t^i_j)$ calculated from the model function, wherein the objective function preferably is defined as

$$\chi^2 = \sum_{i,j}\left(p^i_j - P_i I^*(\underline{a}(x),t^i_j)\right)^2.$$

8. An apparatus according to claim 1, characterized in that the estimation of the parameter vector a(x) makes use of an anatomical reference data set.

9. An X-ray examination system, comprising

- a rotational X-ray apparatus (3) for generating X-ray projections p^i_j of an object (2) from different directions;
- an image processing apparatus (1) coupled to the X-ray apparatus (3) and adapted to estimate based on said projections p^i_j the N-dimensional parameter vector a(x) of a predetermined model function I*(a(x),t) that approximates the representation I(x,t) of the object (2).

10. The system according to claim 9, characterized by an image processing apparatus (1) according to one of claims 1 to 8.

11. The system according to claim 9, characterized in that the rotational X-ray apparatus is a C-arm system (3) or a multi-slice CT system.

12 The system according to claim 9, comprising an injection system for injecting a contrast agent into the blood flow of a patient.

13. A method for the reconstruction of time-dependent representations of an object (2), comprising the following steps:

- approximation of the function I(x,t) which describes the representations by a predetermined parametric model function I*(a(x),t); and
- estimation of the N-dimensional parameter vector a(x) with the help of a set of projections p^i_j of the object (2) generated at times t^i_j.

14. The method according to claim 13, characterized in that the projections p^i_j are generated with a C-arm system (3) or a multi-slice CT system.

15. A computer program for enabling carrying out a method according to claim 14.

16. A record carrier on which a computer program according to claim 15 is stored.

17. An X-ray system suitable for determining a 3D dynamic process in an object (2), the system comprising

an x-ray source and an x-ray detector placed at opposite positions with respect to an examination space and simultaneously rotatable around said examination space for generating a plurality of x-ray projections;

a data processing unit for deriving from said plurality of x-ray projections a map of the time dependent 3D dynamic process in the object (2);

whereby the 3D dynamic process is approximated by a predetermined model with a limited set of parameters;

whereby the data processing unit is arranged to estimate parameters in said limited set of parameters out of data in the x-ray projections.

18. The X-ray system according to claim 17, whereby the predetermined model approximates the perfusion of contrast medium in tissue.

19. The X-ray system according to claim 17, whereby the x-ray system is a C-arm x-ray device or a multi-slice CT system.